US008043561B2

(12) **United States Patent**
Yamakawa et al.

(10) **Patent No.: US 8,043,561 B2**
(45) **Date of Patent: Oct. 25, 2011**

(54) **ANALYZER, CONVEYANCE DEVICE, AND TRANSPORT ANOMALY DETERMINATION METHOD**

(75) Inventors: **Nobuyoshi Yamakawa**, Kobe (JP); **Hiroyuki Tanaka**, Kobe (JP)

(73) Assignee: **Sysmex Corporation**, Kobe (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1168 days.

(21) Appl. No.: **10/891,980**

(22) Filed: **Jul. 14, 2004**

(65) **Prior Publication Data**

US 2005/0036913 A1 Feb. 17, 2005

(30) **Foreign Application Priority Data**

Jul. 17, 2003 (JP) 2003-198373

(51) **Int. Cl.**
G01N 37/00 (2006.01)
G01D 11/00 (2006.01)

(52) **U.S. Cl.** **422/65**; 422/66; 422/67; 422/63; 422/68.1; 436/55; 700/80; 700/79; 700/110; 700/266

(58) **Field of Classification Search** 422/63–67, 422/99, 100, 102, 50, 62, 68.1; 436/55; 700/80, 700/79, 108, 109, 110, 266
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,528,159	A *	7/1985	Liston	422/65
5,209,903	A	5/1993	Kanamori et al.	
5,719,059	A *	2/1998	Mimura et al.	436/50
6,599,476	B1 *	7/2003	Watson et al.	422/63

FOREIGN PATENT DOCUMENTS

JP	06-11057	2/1994
JP	7-239333	9/1995
JP	10-019899	1/1998
JP	11-237384	8/1999

OTHER PUBLICATIONS

Office Action for Japanese Patent Application No. JP2003-198373.

* cited by examiner

Primary Examiner — Jill Warden
Assistant Examiner — Cedric Chan
(74) *Attorney, Agent, or Firm* — Brinks Hofer Gilson & Lione

(57) **ABSTRACT**

Analyzers are described that include a conveyance device for transporting containers which contain analyte, each container having identification information; an identification information reader for reading an identification information of a container transported at a first position by the conveyance device; an analyzer body for acquiring an analyte from a container transported at a second position by the conveyance device and analyzing the analyte; and an anomaly notification device for reporting an anomaly if the identification information reader consecutively reads the same identification information. Conveyance device and transport anomaly determination method are also described.

11 Claims, 8 Drawing Sheets

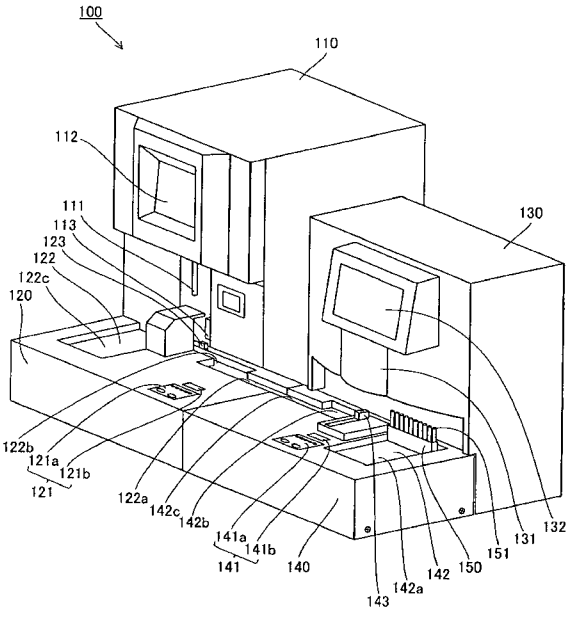


Fig.1

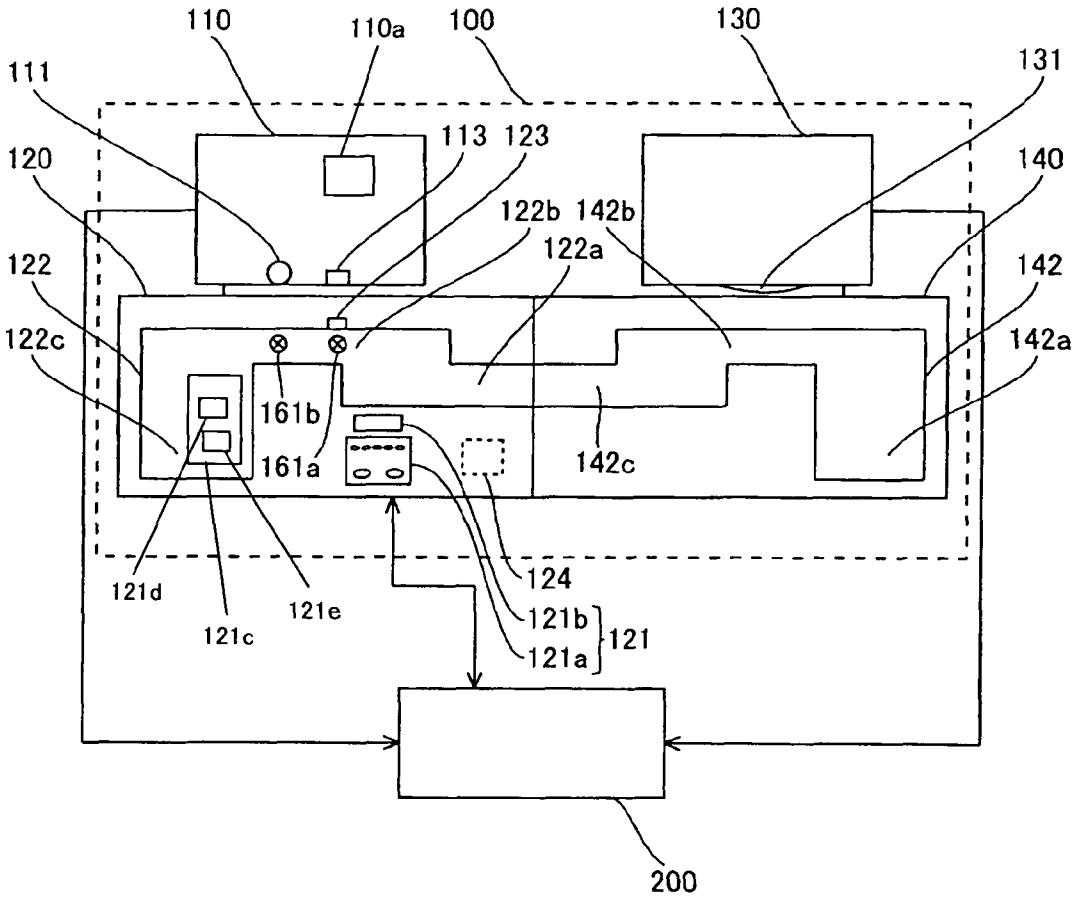

110
110a
100
130
131
111
113
123
120
140
122b
142b
122a
122
142
122c
142a
161b
161a
142c
124
121d
121e
121c
121b
121a
121
200

Fig.2

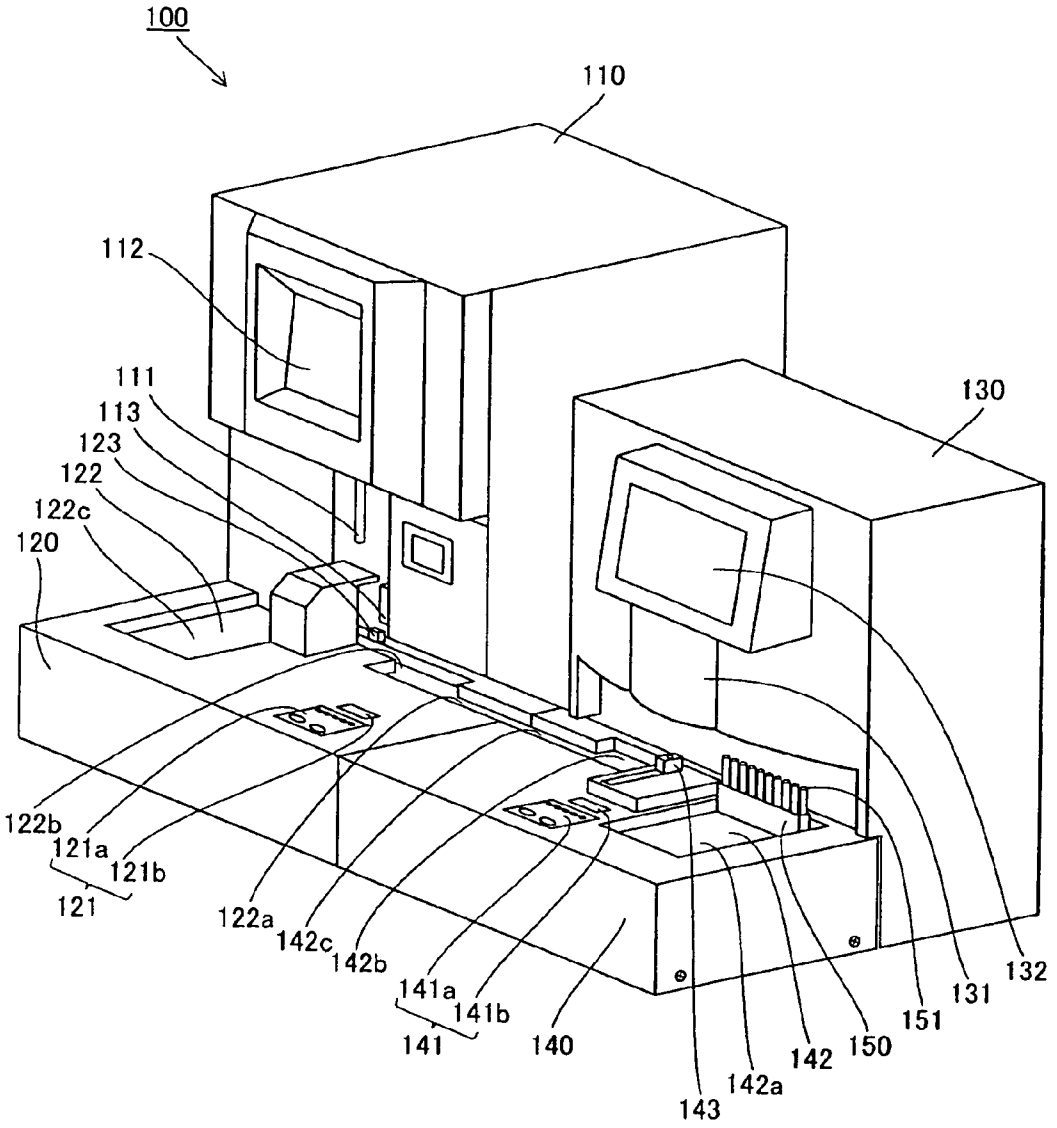

100
110
112
111
113
123
122
122c
120
130
122b
121a
121b
121
122a
142c
142b
141a
141b
141
140
143
142a
142
150
151
131
132

Fig.3

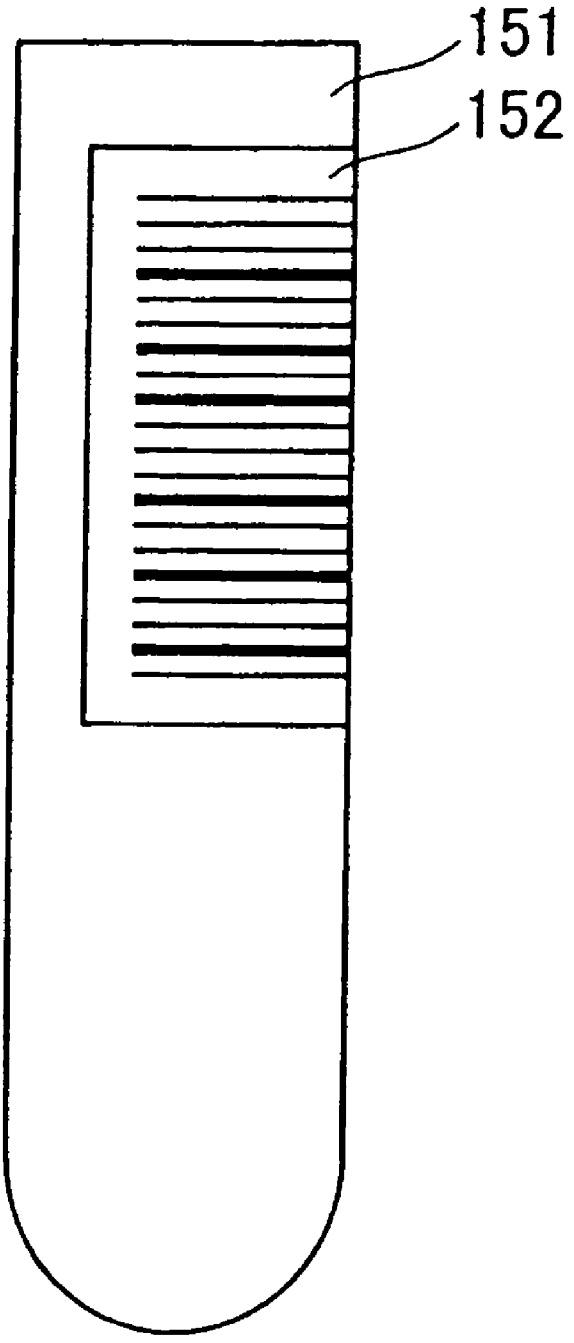


Fig.4

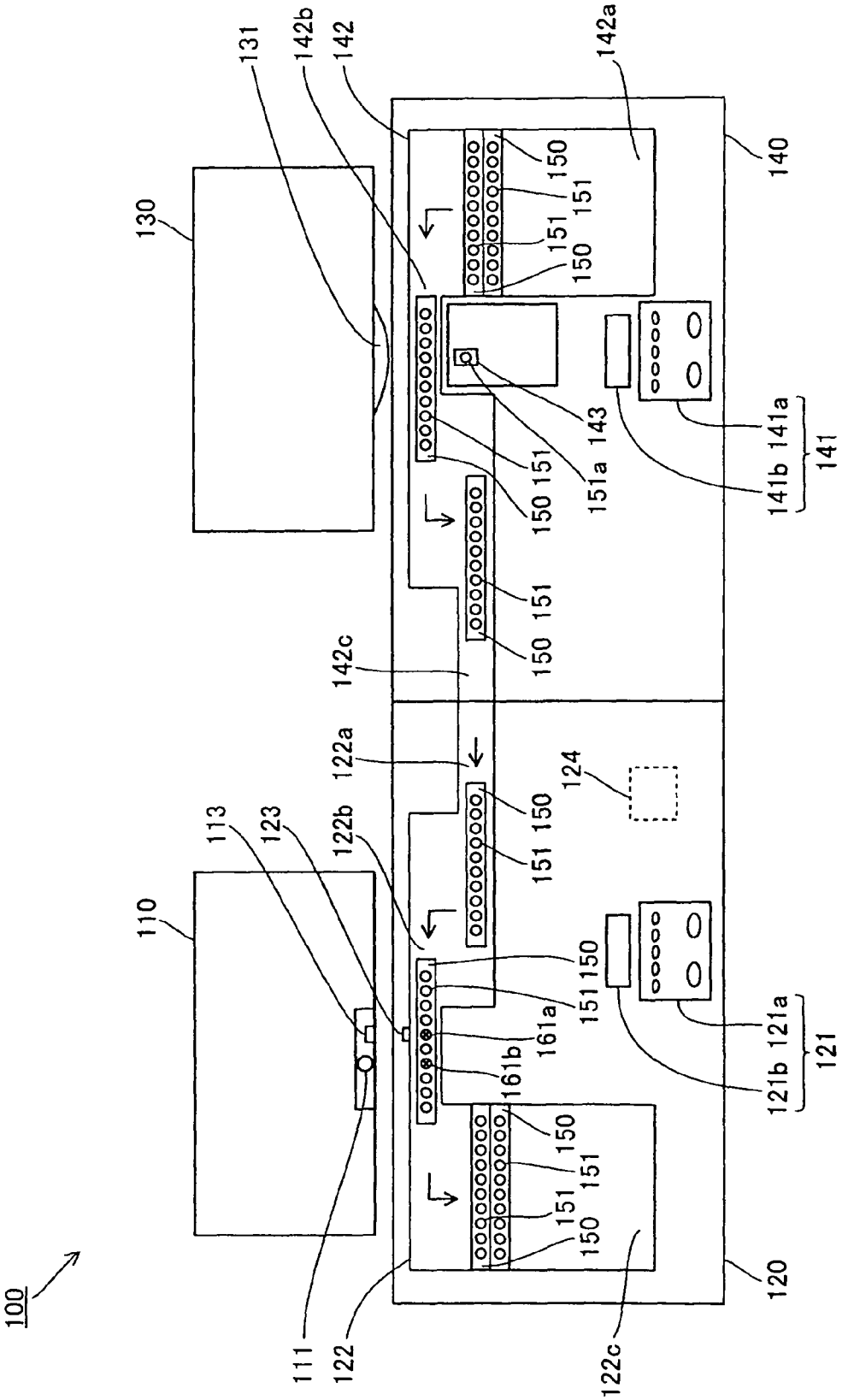

131
142b
142
142a
140
130
150
151
143
151a
141b
141a
141
142c
122a
124
113
123
122b
110
161a
161b
121b
121a
121
120
111
122
122c
100

Fig.5

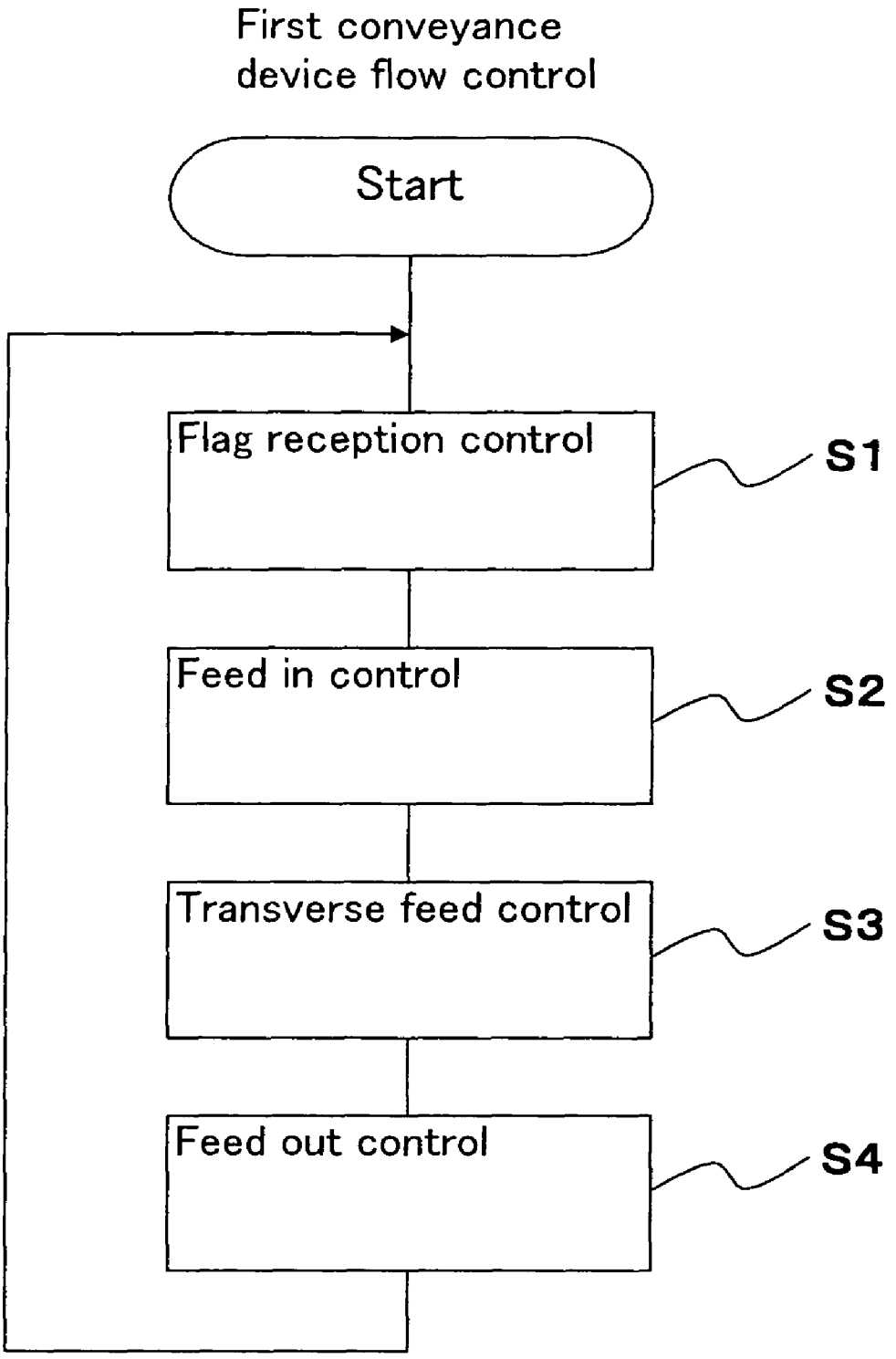

First conveyance device flow control
Start
Flag reception control
S1
Feed in control
S2
Transverse feed control
S3
Feed out control
S4

Fig.6

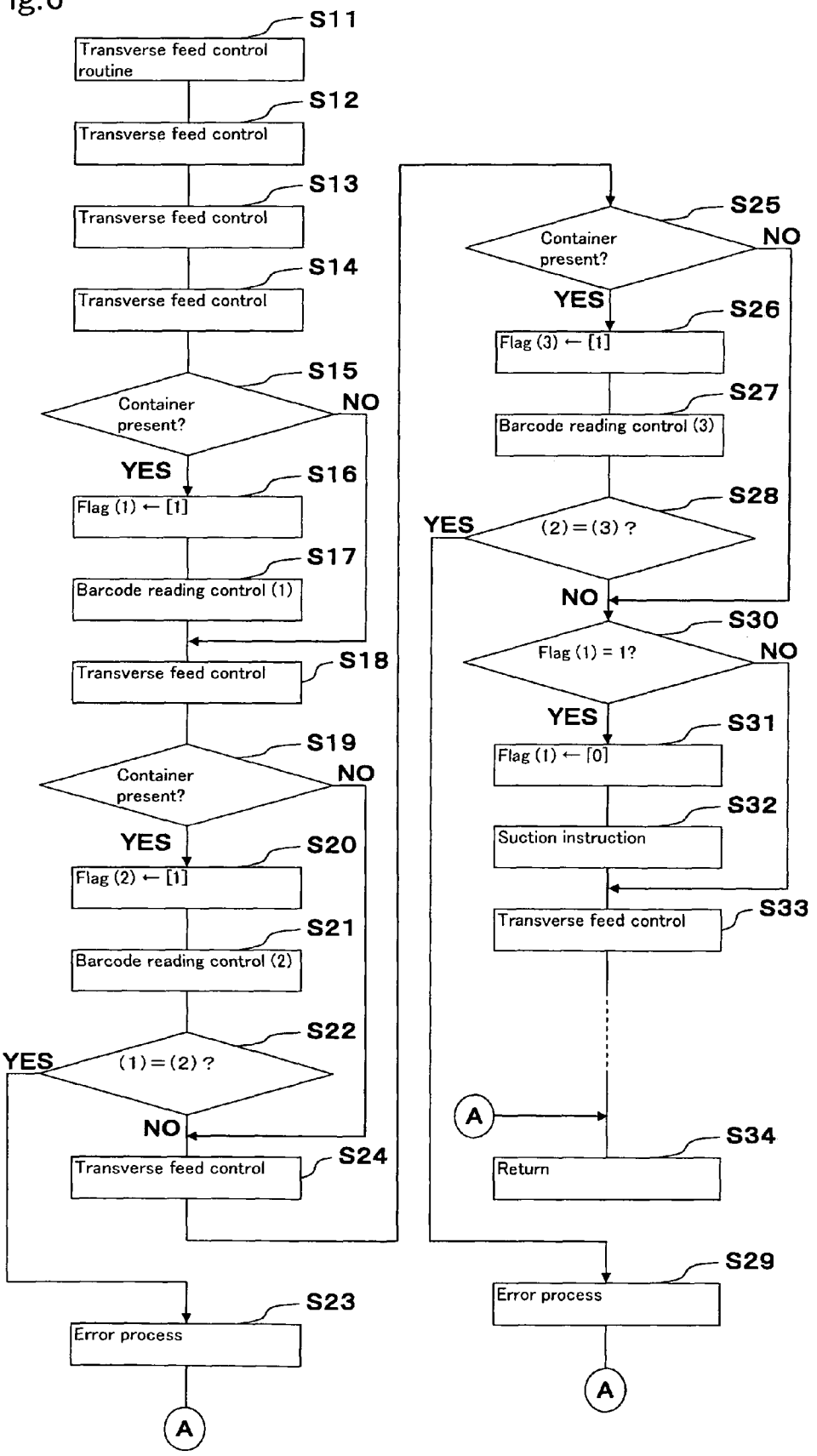

S11
Transverse feed control routine
S12
Transverse feed control
S13
Transverse feed control
S14
Transverse feed control
S15
Container present?
NO
YES
S16
Flag (1) ← [1]
S17
Barcode reading control (1)
Transverse feed control
S18
S19
Container present?
NO
YES
S20
Flag (2) ← [1]
S21
Barcode reading control (2)
S22
YES
(1) = (2) ?
NO
Transverse feed control
S24
S23
Error process
A
S25
Container present?
NO
YES
S26
Flag (3) ← [1]
S27
Barcode reading control (3)
S28
YES
(2) = (3) ?
NO
S30
Flag (1) = 1?
NO
YES
S31
Flag (1) ← [0]
S32
Suction instruction
Transverse feed control
S33
A
S34
Return
S29
Error process
A

Fig.7

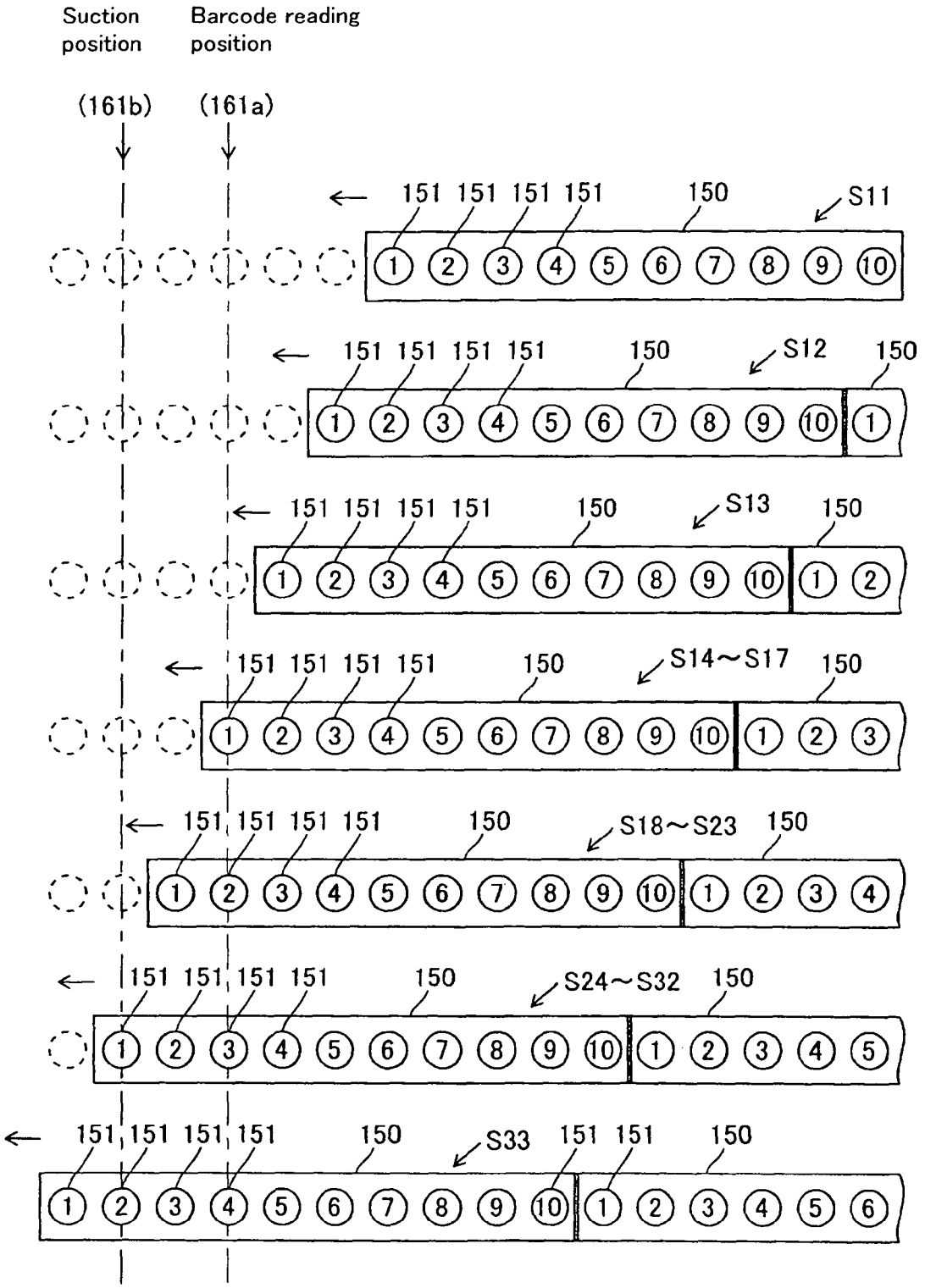
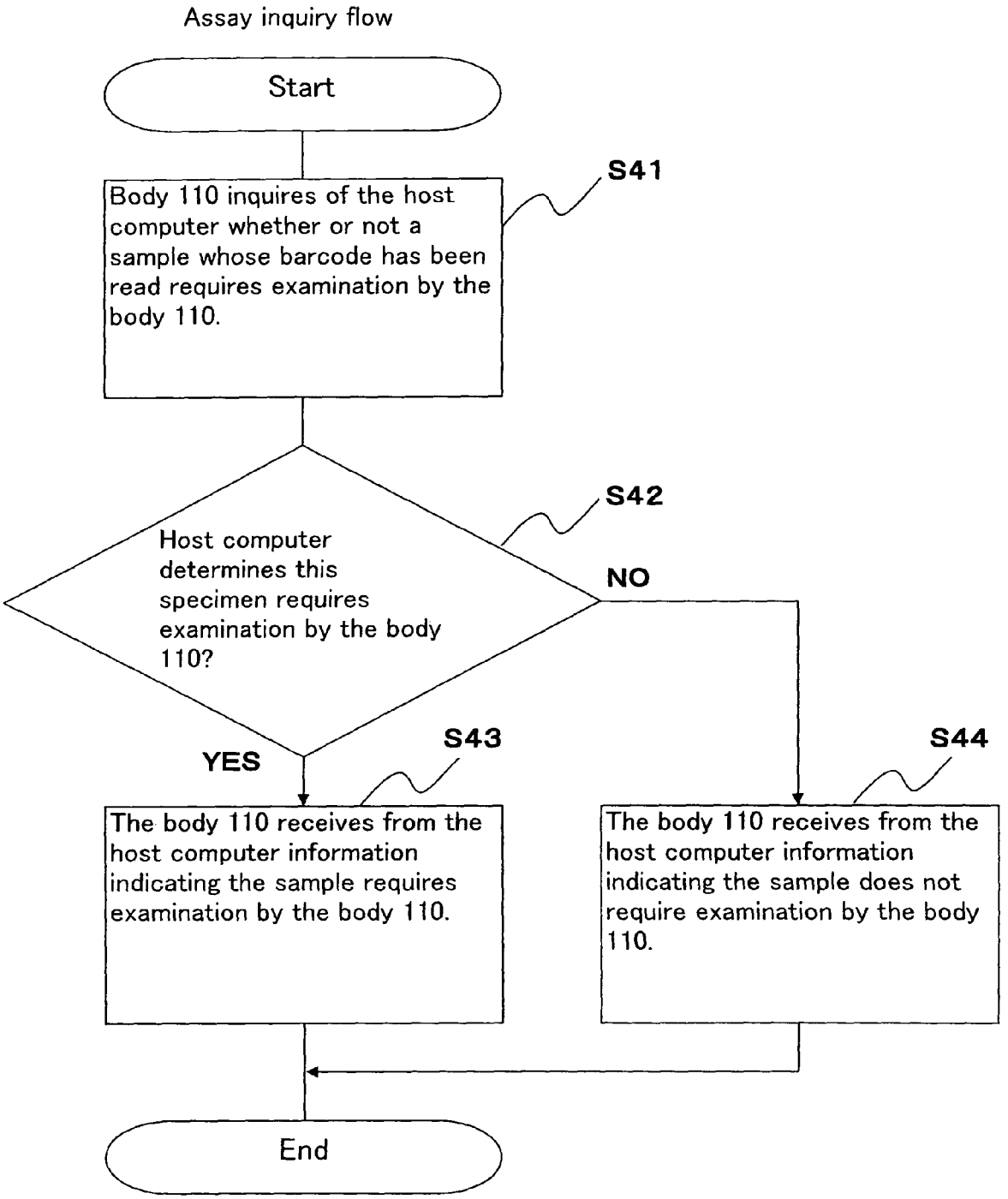

Suction position
Barcode reading position
(161b)
(161a)
151 151 151 151
150
S11
S12
S13
S14~S17
S18~S23
S24~S32
S33
1 2 3 4 5 6 7 8 9 10

Fig.8


Assay inquiry flow
Start
S41
Body 110 inquires of the host computer whether or not a sample whose barcode has been read requires examination by the body 110.
S42
Host computer determines this specimen requires examination by the body 110?
NO
YES
S43
S44
The body 110 receives from the host computer information indicating the sample requires examination by the body 110.
The body 110 receives from the host computer information indicating the sample does not require examination by the body 110.
End

ANALYZER, CONVEYANCE DEVICE, AND TRANSPORT ANOMALY DETERMINATION METHOD

FIELD OF THE INVENTION

The present invention relates to an analyzer including conveyance devices for transporting containers accommodating analyte, a conveyance device, and transport anomaly determination method.

BACKGROUND

Conventionally, analyzing systems which analyze specimens via an analyzer while specimen containers are transported by a conveyance device have become widespread in the effort for more efficient examinations. Specimen inspection systems which read a barcode as identification information from a transported specimen container and subsequently transport the container and suction the specimen are well known as examples of such analyzing systems (for example, refer to Japanese Laid-Open Patent Publication No. 7-239333).

In the specimen inspection system disclosed in Japanese Laid-Open Patent Publication No. 7-239333, each analysis item to be analyzed is determined after a barcode is read and before a sample is suctioned, such that it is possible for the analyzer to quickly suction a sample when the sample container has arrived at the suction position. In this way the examination speed can be increased since the analyzer does not enter a standby state when the suctioning process is performed.

In the specimen inspection system disclosed in Japanese Laid-Open Patent Publication No. 7-239333, however, there are occasions when an anomaly of the conveyance device may occur after the barcode of the transported sample container has been read but before the sample has been suctioned from the sample container whose barcode has been read, such that the sample container remains stopped at the barcode reading position and is not transported; in this case an inconvenience arises inasmuch as the sample container cannot be transported normally. Furthermore, there are occasions when, after the barcode of a sample container being transported has been read but before the sample has been suctioned from the container whose barcode has been read, a user may remove the sample container from the rack and return it one position behind a specific position in the rack, such that the sample container is not transported normally.

When a sample container is not transported normally after the barcode has been read from the sample container being transported but before the sample has been suctioned from the container whose barcode has been read, a problem arises which causes a reduction in the examination reliability inasmuch as a sample accommodated in a sample container which is different than the sample container whose barcode has been read may be erroneously suctioned as the sample of the container whose barcode has been read.

SUMMARY

The scope of the present invention is defined solely by the appended claims, and is not affected to any degree by the statements within this summary.

First analyzer, conveyance device, and transport anomaly determination method embodying features of the present invention improve reliability of examinations.

Second analyzer embodying features of the present invention includes a conveyance device for transporting containers which contain analyte, each container having identification information; an identification information reader for reading an identification information of a container transported at a first position by the conveyance device; an analyzer body for acquiring an analyte from a container transported at a second position by the conveyance device and analyzing the analyte; and an anomaly notification device for reporting an anomaly if the identification information reader consecutively reads the same identification information.

Second conveyance device embodying features of the present invention includes an identification information reader for reading at a first position an identification information of a transport object, each transport object having an identification information; a conveyor for transporting to a second position the transport object whose identification information has been read; and an anomaly notification device for reporting an anomaly if the identification information reader consecutively reads the same identification information.

Second transport anomaly determination method embodying features of the present invention includes a first reading process for reading at a first position an identification information of a transport object, each transport object having an identification information; a transport process for transporting a transport object whose identification information has been read to a second position; a second reading process for reading an identification information from a transport object present at the first position after the transport process has been executed; and ananomaly determining process for determining that an anomaly has occurred during the transport of a transport object if the identification information read in the second reading process is identical to the identification information read in the first reading process.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram showing the relationship between the host computer and an analyzing system of an embodiment of the present invention;

FIG. **2** is a perspective view showing the overall structure of the analyzing system of the embodiment shown in FIG. **1**;

FIG. **3** is a brief illustration showing the sample barcode of a sample container used in the analyzing system of the embodiment shown in FIG. **1**;

FIG. **4** is a brief illustration of the operation of the analyzing system of the embodiment shown in FIG. **2**;

FIG. **5** is a flow chart showing the control flow of a first conveyance device in an analyzing system of an embodiment of the present invention;

FIG. **6** is a flow chart showing details of the transverse feed control routine shown in FIG. **5**;

FIG. **7** briefly shows the relationship between the position of the sample container in the sample rack and the suctioning position and the barcode reading position in the transverse feed control routine shown in FIG. **6**; and

FIG. **8** is a flow chart illustrating the assay inquiry operation of the analyzing system of an embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENT

The embodiments of the present invention are described hereinafter based on the drawings.

FIG. **1** is a block diagram showing the relationship between the user side host computer and the analyzing system of an embodiment of the present invention; FIG. **2** is a perspective view showing the overall structure of the analyzing system of the embodiment shown in FIG. **1**. FIG. **3** is a brief illustration showing a sample barcode of a sample container used in the analyzing system of the embodiment shown in FIG. **1**.

First, the overall structure of the analyzing system **100** of the present embodiment is described with reference to FIGS. **1** through **3**. The analyzing system **100** of the present embodiment is provided with a first analyzer including a body **110** and first conveyance device **120**, and a second analyzer including a body **130** and a second conveyance device **140**.

The body **110** is connected to a user side host computer **200** and the first conveyance device **120**, and the body **130** is connected to the user side host computer **200** and the second conveyance device **140**. Furthermore, the first conveyance device **120** is connected to the user side host computer **200**, body **110**, and second conveyance device **140**. In addition, the second conveyance device **140** is connected to the body **130** and the first conveyance device **120**.

The body **110** and the body **130** of the present embodiment are, for example, urine analyzers. In this case, as shown in FIG. **2**, the body **110** is connected to the latter part of the body **130**, and is installed to perform analysis and examination more detailed than the urinalysis result of the body **130**. The first conveyance device **120** automatically supplies samples to the body **110**, and the second conveyance device **140** automatically supplies samples to the body **139**. Furthermore, the body **110** includes a controller **110***a*, a suction unit (assay unit) **111** and display unit **112**, as shown in FIGS. **1** and **2**. The suction unit **111** is provided to suction a sample accommodated in a sample container **151** which has been delivered to the suctioning position **161***b* (refer to FIG. **1**). The body **130** includes an assay unit **131** and display unit **132**, as shown in FIGS. **1** and **2**.

In the present embodiment, the suction unit **111** of the body **110** is positioned a predetermined distance on the upstream side of the conveyance device **120**, and is provided with a barcode reader **113**, as shown in FIGS. **1** and **2**. The barcode reader **113** is positioned to read a sample barcode on a sample barcode label **152** adhered to a sample container **151** shown in FIG. **3**. A sample number is provided as information included in the sample barcode. The sample numbers are allocated such that each sample has a different number to identify each sample. Furthermore, a sensor (optical sensor) **123** for detecting the presence of a sample container **151** at the barcode reading position **161***a* is provided at the position of the first conveyance device **120** opposite the barcode reader **113**.

In the present embodiment, a setting unit **121** is provided on the first conveyance device **120** for setting the operation of the first conveyance device **120** and displaying the setting content and transport anomaly of the first conveyance device **120**. The setting unit **121** includes a key input unit **121***a* having a plurality of setting keys, and an LCD display unit **121***b* for displaying the setting content and transport anomaly and the like. Furthermore, the first conveyance device **120** is provided with a controller **121***c* for storing the setting content and transport anomaly of the first conveyance device **120**. The controller **121***c* includes a memory **121***d* having a ROM and RAM, and a CPU **121***e*.

The first conveyance device **120** is provided with a built-in speaker **124** for providing audible notification, such as a beeping sound, when a transport anomaly occurs in the first conveyance device **120**.

The first conveyance device **120** is provided with a conveyor **122** for transporting a sample rack **150** holding a plurality of sample containers **151** (ten in the present embodiment) which accommodate samples, as shown in FIGS. **1** and **2**. The conveyor **122** includes a transport part **122***a*, transverse feed part **122***b*, and collection part **122***c*. As shown in FIG. **2**, the second conveyance device **140** includes a setting unit **141** for setting the operation of the second conveyance device **140**, conveyor **142** for transporting a sample rack **150** holding a plurality of sample containers **151** which accommodate samples, and an interrupt sample processing unit **143** used when interrupting the normal sample assay for a special assay. The setting unit **141** includes a key input unit **141***a* having a plurality of setting keys, and an LCD display unit **141***b* for displaying the setting content and the like. The conveyor **142** includes a transport part **142***a*, transverse feed unit **142***b*, and discharge unit **142***c*.

FIG. **4** briefly illustrates the assay operation of the analyzing system of the present embodiment shown in FIG. **2**. FIG. **5** is a flow chart showing the control flow of the first conveyance device in the analyzing system of the present embodiment, and FIG. **6** is a flow chart showing details of the transverse feed control in the control flow of the first conveyance device shown in FIG. **5**. FIG. **7** briefly illustrates the relationship between the position of the sample container within the sample rack and the barcode reading position and suction position at each step in the transverse feed control routine shown in. FIG. **6**. The assay operation of the analyzing system of the present embodiment is described below with reference to FIGS. **1** through **7**. The controller **121***c* runs programs for performing the process shown in the flow charts of FIGS. **5** and **6**.

In the analyzing system **100** of the present embodiment, the sample rack **150** holding a plurality of sample containers **151** accommodating samples (urine) is automatically transported in the arrow direction as shown in FIG. **4**. Specifically, first, the sample rack **150**, which holds a plurality of sample containers **151** accommodating samples, is placed in the transport unit **142***a* of the second conveyance device **140**. Then, the start key is pressed on the setting unit **141**. In this way the sample rack **150** placed in the transport unit **142***a* of the second conveyance device **140** is transported to the transverse feed unit **142***b*. Then, the sample rack **150** is transported to the assay unit **131** of the body **130** via the transverse feeding of the sample rack **150** one sample container **151** at a time by the transverse feed unit **142***b*. Next, in the assay unit **131** of the body **130**, all the samples accommodated in the sample containers **151** held in the sample rack **150** are sequentially assayed. As shown in FIG. **1**, the assay data are transmitted from the body **130** to the host computer **200**. Furthermore, after the sample rack **150** is transported from the transverse feeding unit **142***b* to the discharge unit **142***c*, the sample rack **150** is transported to the transport unit **122***a* of the first conveyance device **120**.

The first conveyance device **120** detects the sample rack **150** transported to the transport unit **122***a*, and starts the transport operation in the arrow direction shown in FIG. **4**. The operation of the first conveyance device **120** is briefly described below with reference to FIGS. **1**, **4** and **5**. First, the sample rack **150**, which has been transported from the discharge unit **142***c* of the second conveyance device **140**, is received by the transport unit **122***a* of the first conveyance unit **120** via the rack reception control in step **1** (S**1**) shown in FIG. **5**. Thereafter, the sample rack **150**, which has been transported to the transport unit **122***a* of the first conveyance device **120**, is transported to the transverse feed unit **122***b* of the first conveyance device **120** via the feed control of step **2** (S**2**). Next, the sample rack **150** is transported to the suction unit **111** of the body **110** by the transverse feeding of the

sample containers **151** one container at a time by the transverse feed unit **122***b*. In the suction unit **111** of the body **110**, only the samples determined to require detailed examination by the body **110** are assayed based on the urinalysis results of the body **130**. Thereafter, the assay result is transmitted from the body **110** to the host computer **200** (refer to FIG. **1**). Then, the sample rack **150** is transported from the transverse feed unit **122***b* to the collection unit **122***c* by the feed control in step **4** (S**4**).

Details of the transverse feed control in the first conveyance device **120** are described below with reference to FIGS. **1**, **3**, **6**, and **7**. This control is executed by the controller **121***c*. First, the start time of the transverse feed control routine in step **11** (S**11**) shown in FIG. **6** corresponds to the state directly after the end of the feeding of the sample rack **150** from the transport unit **122***a* to the transverse feed unit **122***b* of the first conveyance **120**. In this case, the first sample container **151** accommodated at the left end of the sample rack **150** is positioned three container spaces in front of the barcode reading position **161***a*, as shown in FIG. **7**. From this state, the sample rack **150** approaches the barcode reading position **161***a* one sample container **151** space at a time in one cycle of the transverse feed routine in step **12** (S**12**), as shown in FIG. **7**. The first sample container **151** positioned at the left end of the sample rack **150** arrives at the barcode reading position **161***a*, as shown in FIG. **7**, via the transverse feed control executed in step **13** (S**13**) and step **14** (S**14**), shown in FIG. **6**.

In this state, the sensor **123** (refer to FIG. **1**) determines whether or not a sample container **151** is present in step **15** (S**15**), as shown in FIG. **6**. When a sample container **151** is determined to be present in step **15**, a flag corresponding to the first sample container **151** is raised in step **16** (S**16**). This flag is stored in a first region of the memory **121***d*.

Thereafter, the sample barcode of the sample barcode label **152** (refer to FIG. **3**) of the first sample container **151** positioned at the left end of the sample rack **150** is read by the barcode reader **113** (refer to FIG. **1**) via the barcode reading control (**1**) of step **17** (S**17**). Subsequently, the second sample container **151** from the left end of the sample rack **150** arrives at the barcode reading position **161***a*, as shown in FIG. **7**, via the transverse feed control of step **18** (S**18**).

When it is determined that the first sample container **151** positioned at the left end of the sample rack **150** is not present in step **15**, the sample barcode reading is not performed and the second sample container **151** arrives at the barcode reading position **161***a* via the transverse feed control of step **18**.

Thereafter, the sensor **123** (refer to FIG. **1**) determines whether or not a sample container **151** is present at the position of the second sample container **151** from the left end of the sample rack **150** in step **19** (S**19**). When it is determined that a sample container **151** is present in step **19**, then a flag corresponding to the second sample container **151** is raised in step **20** (S**20**). This flag is stored in a second region of the memory **121***d*. Then, the sample barcode of the sample barcode label **152** (refer to FIG. **3**) of the second sample container **151** is read by the barcode reader **113** (refer to FIG. **1**) via the barcode reading control (**2**) of step **21** (S**21**).

Next, a determination is made in step **22** (S**22**) as to whether or not the barcode of the first sample container **151** read in step **17** matches the barcode of the second sample container **151** read in step **21**, and when the barcodes match, an error process is executed in step **23** (S**23**).

The specific content of the error process includes the execution of error notifications via an error display on the LCD display unit **121***b* of the setting unit **121** and an audible error notification using the speaker **124** shown in FIG. **1**, as well as suspending the transport operation of the first conveyance device **120**. The error display shown on the LCD display unit **121***b* may be a displayed message such as, for example, "rack feed error." Furthermore, when the transport of the conveyor **122** of the first conveyance device **120** is suspended, the conveyor **122** does not receive the sample rack **150** even when a sample rack **150** is transported from the conveyor **142** of the second conveyance device **140** to the conveyor **122** of the first conveyance device **120**.

When it is determined in step **22** that the sample barcode of the second sample container **151** read in step **21** does not match the sample barcode of the first sample container **151** read in step **17**, then a third sample container **151** is delivered to the barcode reading position **161***a*, as shown in FIG. **7** and the first sample container **151** is delivered to the suction position **161***b* via the transverse feed control of step **24** (S**24**). When it is determined that a second sample container **151** is not present in step **19**, the sample barcode reading is not performed, and the third sample container **151** is delivered to the barcode reading position **161***a*, and the first sample container **151** is delivered to the suction position **161***b* via the transverse feed control of step **24**.

In step **25** (S**25**), the sensor **123** (refer to FIG. **1**) detects whether or not a sample container **151** is present at the position which accommodates the third sample container **151** from the left end of the sample rack **150**. When it is determined that a third sample container is present in step **25**, then a flag indicating the presence of the third sample container **151** is raised in step **26** (S**26**). This flag is stored in a third region in the memory **121***d*. Next, the sample barcode of the sample barcode label **152** (refer to FIG. **3**) of the third sample container **151** is read by the bar code reader **113** (refer to FIG. **1**) via the barcode reading control (**3**) of step **27** (S**27**).

In step **28** (S**28**), a determination is made as to whether or not the barcode of the third sample container **151** read in step **27** matches the barcode of the second sample container **151** read in step **21**, and when the barcodes match, the same error process executed in step **23** is executed in step **29** (S**29**). When it is determined that the sample barcode of the second sample container **151** and ,the sample barcode of the third sample container **151** do not match in step **28**, then a determination is made as to whether or not a flag indicating the presence of a first sample container **151** is raised in step **30** (S**30**). When it is determined that a third sample container is not present in step **25**, the barcode reading is not performed and the routine moves to step **30**.

When it is determined that a flag indicting the presence of a first sample container **151** is raised in step **30**, then the flag stored in the first region of the memory **121***d* is returned to [0] in step **31** (S**31**). Then, in step **32** (S**32**), suction instructions are issued for the first sample container **151** of the sample rack **150** positioned at the suction position **161***b* (refer to FIG. **7**). Thereafter, the second sample container **151** of the sample rack **150** is delivered to the suction position **161***b* and the fourth sample container **151** is delivered to the barcode reading position **161***a* via the transverse feed control of step **33** (S**33**). Subsequently, the same operations of steps **25** through **32** are repeated. After the same controls of steps **25** through **32** have been performed for the tenth sample container **151** of the sample rack **150**, then the operations from the transverse feed control routine are repeated via the routine of step **34** (S**34**) from the first sample container **151** of the next sample rack **150**.

Since the flag for issuing the suction instruction is returned to [0] for the first through tenth sample containers **151** of the previous sample rack **150** as described above, the flag can be raised again from the first sample container **151** of the next sample rack **150**. Furthermore, since a determination is made

as to whether or not the sample barcodes match between the tenth sample container **151** of the previous sample rack **150** and the first sample container **151** of the next sample rack **150**, when the barcodes match the same error process as executed in step **23** is executed.

In the present embodiment, an assay inquiry to determine whether or not the body **110** is required to perform an assay is issued after the sample barcode, of the first sample container **151** has been read in step **17** but before the suction instruction has been issued for the first sample container. The assay inquiry operation is described below with reference to FIG. **8**. The assay. inquiry operation is performed by the controller **110***a* of the body **110**. First, in step **41** (S**41**), the body **110** issues an inquiry to the host computer **200** as to whether or not the sample accommodated in the sample container **151** whose barcode has been read requires examination by the body **110**. Then, in step **42** (S**42**), the host computer **200** determines whether or not this sample requires examination by the body **110** based on the assay data transmitted from the body **130**.

When it is determined that examination by the body **110** is required in step **42**, the body **110** receives from the host computer **200** information specifying that examination is required by the body **110** in step **43** (S**43**). In this case, the sample is suctioned by the suction unit **111** of the body **110** based on the suction instructions of step **32** shown in FIG. **6**.

When the host computer **200** determines that examination of the sample by the body **110** is not required in step **42**, then the body **110** receives from the host computer **200** information specifying that examination by the body **110** is not required in step **44** (S**44**). In this case, the sample is not suctioned by the suction unit **111** of the body **110** even though the suction instruction of step **32** has been issued.

As described above the determination as to whether or not detailed examination by the body **110** is required is made after the barcode has been read at the barcode reading position **161***a* but before the sample container **151** is delivered to the suction position **161***b*. In this way the suction unit **111** suctions only the samples determined to require detailed urinalysis by the body **110** among the sample containers **151** delivered to the suction position **161***b*. Then, sample assay data obtained by the body **110** are transmitted from the body **110** to the host computer **200**, as shown in FIG. **1**. The assay data transmitted from the body **110** to the host computer **200** do not include graphic data, such as large quantities of scatter data. In this way a concentration of data can be suppressed in the path from the body **110** to the host computer **200**, such that when an assay inquiry is issued from the body **110** to the host computer **200**, no response or delayed response from the host computer is avoided.

In the present embodiment, when the barcode reader consecutively reads the same barcode, an error message is displayed on the LCD display unit **121***b* of the setting unit **121** and an audio error notification is issued through the speaker **124**, such that a user can easily recognize that a sample container **151** is not transported normally from the barcode reading position **161***a* to the suction position **161***b* when an anomaly occurs in the first conveyance device **120** and the sample container **151** remains stopped and is not transported to the barcode reading position **161***a*, and when a user removes a sample container **151** from the sample rack **150** and erroneously replaces the sample container **151** one position behind the specified position on the rack. Since a user can manage transport anomalies in this way, a sample accommodated in a different sample container **151** than the sample container **151** that was read by the barcode reader is prevented from being erroneously suctioned as the sample of the sample container **151** which was read by the barcode reader. As a result, examination reliability is improved even when the barcode reading position **161***a* differs from the suction position **161***b*.

Furthermore, since the transport of the sample container **151** is suspended when the barcode reader **123** has consecutively read the same sample barcode, and the transport of the sample container **151** does not continue when the user is unaware of the notification of an anomaly via the LCD display **121***b* and the speaker **124**, a sample accommodated in a different sample container **151** than the sample container **151** whose barcode was read is not erroneously suctioned as the sample of the sample container **151** whose barcode was read. Examination reliability is thus improved in this way.

In the present embodiment, the standby state of the body **110** can be suppressed by inquiring of the host computer **200** whether or not a sample accommodated in a sample container **151** requires examination while the sample container **151** is being transported from the barcode reading position **161***a* to the suction position **161***b*. The examination speed is increased in the body **110** in this way. Furthermore, only samples requiring examination are analyzed by the body **110**.

In the present embodiment, the suction operation may not be performed even when the body **110** receives a suction instruction from the first conveyance device **120** depending on the inquiry from the body **110** to the host computer **200** as to whether or not a sample requires examination.

In the present embodiment, the sample barcode of a sample container **151** is accurately read by providing a sensor **123** for detecting whether or not a sample container **151** is present at the barcode reading position **161***a*.

The disclosed embodiment is in all respects an example and should not be considered as limiting in any way. The scope of the present invention is solely determined by the scope of the claims and not by the description of the embodiment described above, and all modifications included within the scope and equivalent meanings of the claims are included.

For example, although the present embodiment is an example of the present invention applied to an analyzing system including a urine analyzer and a conveyance device, the present invention is not limited to this arrangement, and may be applied to analyzing systems including a conveyance device and other type of analyzer such as a blood analyzer or the like, and analyzing systems including a conveyance device and a smear specimen preparation device. The smear specimen preparation device disclosed in U.S. Pat. No. 6,268,208 may be used as such a smear specimen preparation device.

Although the assay inquiry as to whether or not a sample requires analysis by the body is sent from the body to the host computer in the present embodiment, the present invention is not limited to this arrangement inasmuch as the assay inquiry also may be sent from the first conveyance device to the host computer. In this case, the assay inquiry is also performed after the reading of the sample barcode.

In the present embodiment the barcode reader is provided in the body, however, the present invention is not limited to this arrangement inasmuch as the barcode reader also may be provided in the first conveyance device.

Although a sample barcode is used as an example of sample identification information in the present embodiment, the present invention is not limited to this arrangement inasmuch as identification information other than a barcode, such as an IC chip and the like, also may be used.

In the present embodiment, a speaker is built into the first conveyance device as an example of an anomaly notification device, however, the present invention is not limited to this

arrangement, and a speaker built in to the body also may be used as an anomaly notification device.

Although a speaker and LCD display are used as anomaly notification devices in the present embodiment, the present invention is not limited to this arrangement inasmuch as a light source such as a lamp or the like may also be used as an anomaly notification device. In this case, notification of an anomaly may be accomplished by lighting or flashing the lamp.

In the present embodiment, assay data which do not include graphic data such as scatter data are transmitted from the body **110** to the host computer **200**, however, the present invention is not limited to this arrangement inasmuch as assay data which include graphic data such as scatter data also may be transmitted from the body **110** to the host computer **200**.

Although the analyzer is connected to the body **110** and the first conveyance device **120** in the present embodiment, the present invention also may be applied to an analyzer which integratedly incorporates the first conveyance device **120** into the body **110**.

What is claimed is:

1. An analyzer comprising:

a conveyance device for transporting a rack holding sample containers which contain analyte, each sample container having identification information, wherein the rack holds sample containers in a longitudinal direction thereof, and the conveyance device transports the rack in a predetermined direction straight along the longitudinal direction, such that the sample containers held on the rack are placed at a first position on the conveyance device one by one;

an identification information reader for reading the identification information on a sample container transported to the first position on the conveyance device;

an analyzer body for acquiring an analyte from a sample container transported to a second position on the conveyance device and for analyzing the analyte;

an anomaly notification device for reporting an anomaly; and

a controller in communication with the conveyance device, the identification information reader and the anomaly notification device, the controller configured for controlling the anomaly notification device to report the anomaly if the identification information reader consecutively reads the same identification information during transport of the rack by the conveyance device,

wherein the controller controls the conveyance device to transport a container after the identification information reader has read identification information, controls the identification information reader to again read identification information, and controls the anomaly notification device to report the anomaly if the previously read identification information and the subsequently read identification information are identical.

2. The analyzer of claim **1**, wherein the anomaly notification device comprises an element selected from the group consisting of a light source, a speaker, a display unit, and combinations thereof; and the anomaly report comprises a notification selected from the group consisting of light from the light source, sound from the speaker, a display of the display unit, and combinations thereof.

3. The analyzer of claim **1** further comprising a sensor for detecting whether or not a container is present at the first position, wherein:

the controller controls the identification information reader to read the identification information of the container if the sensor detects the presence of the container at the first position.

4. The analyzer of claim **1**, wherein the conveyance device comprises the controller.

5. An analyzer comprising:

a conveyance device for transporting a rack holding sample containers which contain analyte, each sample container having identification information, wherein the rack holds sample containers in a longitudinal direction thereof, and the conveyance device transports the rack in a predetermined direction straight along the longitudinal direction, such that the sample containers held on the rack are placed at a first position on the conveyance device one by one;

an identification information reader for reading the identification information on a sample container transported to the first position on the conveyance device;

an analyzer body for acquiring an analyte from a sample container transported to a second position on the conveyance device and for analyzing the analyte;

an anomaly notification device for reporting an anomaly;

a controller in communication with the identification information reader and the anomaly notification device, the controller configured for controlling the anomaly notification device to report the anomaly if the identification information reader consecutively reads the same identification information during transport of the rack by the conveyance device; and

a computer connected to the conveyance device and/or analyzer body, wherein:

at least one of the conveyance device and the analyzer body inquires of the computer whether or not analysis of an analyte contained in a container is required after the identification information of the container has been read by the identification information reader at the first position and while the container whose identification information has been read is being transported to the second position.

6. The analyzer of claim **5**, wherein the analyzer body comprises an analyzer side controller, and wherein the inquiry as to whether or not analysis of an analyte contained in a container is required is transmitted from the analyzer side controller to the computer.

7. An analyzer comprising:

a conveyance device for transporting a rack holding sample containers which contain analyte, each sample container having identification information, wherein the rack holds sample containers in a longitudinal direction thereof, and the conveyance device transports the rack in a predetermined direction straight along the longitudinal direction, such that the sample containers held on the rack are placed at a first position on the conveyance device one by one;

an identification information reader for reading the identification information on a sample container transported to the first position on the conveyance device;

an analyzer body for acquiring an analyte from a sample container transported to a second position on the conveyance device and for analyzing the analyte;

an anomaly notification device for reporting an anomaly; and

a controller in communication with the identification information reader and the anomaly notification device, the controller configured for controlling the anomaly notification device to report the anomaly if the identification

information reader consecutively reads the same identification information during transport of the rack by the conveyance device,

wherein the controller controls the conveyance device to stop the transport of the container if the identification information reader consecutively reads the same identification information.

8. An analyzer comprising:

a conveyance device that transports a rack holding sample containers that contain analyte, each sample container having identification information, wherein the rack holds sample containers in a longitudinal direction thereof, and the conveyance device transports the rack in a predetermined direction straight along the longitudinal direction, such that the sample containers held on the rack are placed at a first position on the conveyance device one by one;

an identification information reader configured to read the identification information on a sample container when transported to the first position by the conveyance device;

an analyzer body configured to acquire an analyte from a sample container transported to a second position by the conveyance device and configured to analyze the analyte;

an anomaly notification device that reports an anomaly; and

a controller in communication with the conveyance device, the identification information reader and the anomaly notification device, the controller configured to control the anomaly notification device to report the anomaly if the identification information reader consecutively reads the same identification information at the first position following a conveyance of the sample container from the first position

wherein the controller controls the conveyance device to stop the transport of the container if the identification information reader consecutively reads the same identification information.

9. The analyzer of claim **8** where the identification information reader comprises an optical device that reads identification information at only a single position.

10. The analyzer of claim **8** further comprising a second analyzer body separate from the analyzer body comprising an assay unit that assays the analyte after the container is transported to a third position.

11. An analyzer comprising:

a conveyance device for transporting a rack holding a first sample container and a second sample container adjacent to the first sample container which contain analyte, each sample container having identification information;

an identification information reader for reading the identification information of a sample container transported to a first position on the conveyance device;

an analyzer body for acquiring an analyte from a sample container transported to a second position on the conveyance device and for analyzing the analyte;

an anomaly notification device for reporting an anomaly; and

a controller in communication with the conveyance device, the identification information reader, and the anomaly notification device, the controller configured for performing successive operations comprising:

(1) transporting the first sample container to the first position;

(2) reading identification information of the first sample container transported to the first position;

(3) implementing an operation of transporting the second sample container to the first position;

(4) reading identification information of a sample container placed at the first position;

(5) controlling the anomaly notification device to report the anomaly if identification information read in (2) is the same as identification information read in (4);

(6) controlling the conveyance device to stop the conveyance of the sample container when an anomaly is reported by the anomaly notification device.

* * * * *